

COMPARATIVE PROFITABILITY ANALYSIS OF IPM AND NON-IPM TECHNOLOGY OF CHILLIES CULTIVATION AT KURNOOL DISTRICT OF ANDHRA PRADESH

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ABSTRACT

India is the largest producer, consumer, and exporter of spices in the world and so it is called 'Spice bowl of the world' and also known as the 'The home of spices'. India contributes one-fourth of the world's production of chili. The production of chili in India is dominated by Andhra Pradesh which bestows 58 per cent to the total production. The study was undertaken, in order to study profitability and cost and returns chili cultivation in IPM and non IPM methods. The main objective of the study was to analyze the socio-economic condition, cost and returns of chillies in IPM and non IPM methods. This study was conducted in the Kurnool district of Andhra Pradesh. Totally twelve villages from four mandals were selected as the study area. Data were collected from 60 IPM and 60 non IPM farmers. From the results, it was found that the total cost of cultivation for non IPM farmers was more than the cost incurred by IPM farmers in chili. In cost 'A₁' non-IPM farmers had incurred more cost when compared to IPM farmers. Gross returns were more in case of IPM farmers than non-IPM farmers.

KEYWORDS: Cost and Returns, Chillies, IPM & Partial Budgeting

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INTRODUCTION

Chili is one of the most important commercial spice crops and it is widely used as a universal spice, named as a wonder spice. Chili is botanical '*Capsicum annuum*' and '*Capsicum frutescens*' that come from the genus 'Capsicum,' family of 'Solanaceae,'. Chili has originated in the Latin American regions of New Mexico as a wild crop in 7500 BC. In India, Chillies are grown in almost all the states across the length and breadth of the country. In India, Andhra Pradesh which contributes about 28% to the total area under chilli, followed by Karnataka (16%), Maharashtra (13%), Orissa (10%), West Bengal (8%), and Tamil Nadu (8%), while other states have contributed 7 per cent to the total area under Chillies.

The main objective of the study is to identify the socio-economic condition of the IPM and non- IPM farmers of chili in Kurnool district of Andhra Pradesh and to analyze the cost and returns structure of the Farmers practicing IPM and non-IPM in chili.

METHODOLOGY

The study area, Kurnool district of Andhra Pradesh was purposively selected, as recommended by the case firm. Kurnool district is one of the major chili producing areas of Andhra Pradesh. Here the case firm recommends

the IPM package of practices for chili and buys the produce from the farmers who are following the recommended practices advocated by the firm. The farmers who follow the IPM will not only benefit in terms of the better price for the produce but also they can save the transportation costs and gunny bags cost which are borne by the case firm.

Four mandals from Kurnool district were selected and from each mandal three villages were selected based on the maximum area under chili cultivation which is recommended by the case firm. From each village five IPM farmers and five Non-IPM farmers were selected using the simple random technique. Thus, altogether ten farmers from each village constituted a sample of 120 chili farmers. It comprised of 60 farmers who have adopted IPM and 60 farmers who have not followed IPM.

A well-structured interview schedule was designed for the farm level survey and the same was pretested in the field and modified accordingly. The method of data collection was by personal interview. Since most of the information needed was recalled from the memory of the sample respondents, sufficient care was taken to minimize the recall bias through repeated enquires and cross checks.

Information regarding the type of family, landholding details, experience in IPM chili cultivation, source of income, cost of cultivation, costs involved in IPM components, problems faced by the farmers in adopting IPM practices and reasons for non-adoption of IPM were collected.

Secondary information on land use pattern, rainfall, cropping pattern, source of irrigation, area under chili, etc., were collected with reference to the study area and also for the State from the Department of Economics and Statistics positioned at the Collectorate complex of Kurnool district and from various published sources.

Percentage analysis was used to study the general characteristics of farmers which include age, education, occupation, farming experience, area owned, crops grown in the field, area under Chili, etc. The tabular analysis was used to study the economic characteristics of different size groups of sample farmers such as the size of land holding, cropping pattern, costs and returns expressed by the farmers and for analyzing the data elicited through opinion survey from the sample farmers. The data were compared and contrasted with the help of averages. The concept as employed in farm management studies was followed to estimate the returns and profits of IPM and non-IPM farmers.

Farm Management Cost Concepts

The classification of costs based on Dr.Sen's Committee report (1979) is as follows.

- **Cost - A₁**: It included wages of hired human labor, cost of bullock labor, charges of hired machinery, cost of seed, value of organic manure and chemical fertilizers, value of plant protection components, interest on working capital, depreciation on farm machinery, implements, equipment, farm buildings, land revenue etc.
- **Cost - A₂**: It consists of Cost 'A₁' plus rent paid for leased in the land.
- **Cost - B₁**: Cost 'B₁' consists of cost 'A₁' or 'A₂' plus interest on fixed capital invested in the business excluding the value of the land.
- **Cost - B₂**: Cost 'B₂' consists of Cost 'B₁' plus the rental value of own land.
- **Cost - C₁**: Cost 'C₁' consists of cost 'B₁' plus imputed value of family labor.
- **Cost - C₂**: Cost 'C₂' consists of Cost 'B₂' plus imputed value of family labor.

The above farm management cost concepts were used for calculating the cost of production per hectare of Chilli crop.

RESULTS AND DISCUSSIONS

The study comprises of 60 farmers who have adopted IPM and 60 farmers who have not followed IPM technology. The results of the study are discussed under Socio-economic characteristics of sample farmers, Cost and returns structures of IPM and non-IPM farmers of chilli, Quantities of input utilized and cost incurred by IPM and non-IPM farmers, Partial Budget showing the change from IPM to non-IPM chilli cultivation and Chilli IPM module components and cost incurred by IPM farmers.

Socio-Economic Characteristics of the Sample Farmers

Analyzing the general characteristics of the farmers of Kurnool district with respect to age, educational status, family type, experience in chilly cultivation, occupational status, landholding pattern, source of irrigation and net returns from chili of the household will be helpful to the case firm in accomplishing the needs of the farmers.

Table 1: Socio-Economic Characteristics of Chili Growers

Socio Economic Characters	Classification	IPM Farmers	Non IPM Farmers	Overall
Age group (in yrs)	25-35	28 (46.66)	23 (38.33)	51 (42.50)
	36-45	22 (36.67)	25 (41.67)	47 (39.16)
	46-55	8 (13.33)	9 (15.00)	17 (14.16)
	Above 55	2 (3.33)	3 (5.00)	5 (4.17)
Educational qualification	Illiterate	5 (8.33)	9 (15.00)	14 (11.67)
	Primary school	14 (23.33)	16 (26.67)	30 (25.00)
	Higher secondary	36 (60.00)	33 (55.00)	69 (57.50)
	Graduate	4 (6.67)	2 (3.33)	6 (5.00)
Family type	Nuclear family	23 (38.33)	29 (48.33)	52 (43.33)
	Joint family	37 (61.67)	31 (51.67)	68 (56.67)
Experience in chili farming	Up to 5 Years	12 (20.00)	10 (16.67)	22 (18.33)
	6 to 10 Years	14 (23.33)	11 (18.33)	25 (20.83)
	11 to 15 Years	30 (50.00)	32 (53.33)	62 (51.67)
	16 to 20 Years	3 (5.00)	5 (8.33)	8 (6.67)
	>20 Years	3 (5.00)	2 (3.33)	3 (2.50)
Size of holding	<1 (marginal)	6 (10.00)	3 (5.00)	9 (7.50)
	1-2 (small)	17 (28.30)	20 (33.33)	37 (30.83)
	2-4 (semi med.)	14 (23.33)	15 (25.00)	29 (24.16)
	4-10 (Medium)	20 (33.33)	17 (28.30)	37 (30.83)
	>10 (large)	12 (5.00)	5 (8.33)	17 (14.16)

From the above table, it could be concluded that major share (46.66 per cent) of the respondents belonged to the age group of 25-35 years closely followed by the farmers in the age group of 36-45 years. On the contrary among the non-IPM farmers, 41.67 per cent of them have belonged to the age group of 36-45 years followed by 38.33 per cent belonged to 25-35 years.

Of all the observations, the majority of IPM and non-IPM farmers have belonged to higher secondary level followed by completed their graduation. It was observed that a higher proportion of the joint type of family was observed in case of IPM farmers (61.67%) as compared to non-IPM farmers (51.67%). In the case of the nuclear type of family, reverse was observed i.e., a higher proportion of non-IPM farmers (48.33%) and a relatively lesser proportion of the IPM farmers (38.33%) belonged to this category. Hence, implementation of IPM components in managing the insect pests

problems in chili and to carry out the field operations, the farmers necessarily have depended on the family labor source.

Fifty per cent of the IPM farmers had experience of more than 10 years in chili cultivation and 53.33 per cent from non-IPM farmers. **About** 81.67 per cent of IPM farmers and 75 percent of non-IPM farmers had agriculture as their main occupation. Farmers who had agriculture and other occupation are only 18.33 percent in case of IPM and 25 per cent in non-IPM farmers. From this, it could be concluded that most of the farmers had agriculture as their primary occupation. Of the total, it could be concluded that 30.83 per cent are small farmers and 30.83 are medium farmers in the study area.

From the above table, it could be observed that 53.33 per cent of the IPM farmers and 50.00 per cent of the non-IPM farmers had bore well as their main source of irrigation followed by canals and open well.

Table 2: Net Returns of the Sample Respondents from Chili (Rs.per ha)

S. No.	Net Returns	IPM Farmers	Non IPM Farmers	Overall
1	<85000	2 (3.33)	13 (21.67)	15 (12.50)
2	85001-95000	5 (8.33)	23 (38.33)	28 (23.33)
3	95001-105000	8 (13.33)	19 (31.67)	27 (22.50)
4	105001-115000	14 (23.33)	4 (6.67)	18 (15.00)
5	115001-125000	22 (36.67)	1 (1.67)	23 (19.17)
6	>125000	9 (15.00)	-	9 (15.00)
Total		60 (100)	60 (100)	120 (100)

It could be observed from the table.2 that majority (36.67 per cent) of the IPM farmers are getting Rs.115001 to 125000 and nearly 23.33 per cent of the IPM farmers are earning Rs. 105001 to115000 from chili cultivation per hectare. Very less number of the IPM farmers are under the net returns group of <Rs 85000. It could also be observed that there is 15 per cent of the IPM farmers getting net returns of >Rs. 125000 by chili cultivation. Within the non-IPM farmers, there are 38.33 per cent and 31.67 belonged to the net returns group of Rs.95001-105000 and Rs. 85001-95000 respectively. There is no single farmer getting the net returns of >Rs. 125000 in the non-IPM category.

Cost and Returns Structure of IPM and non-IPM Farmers

Costs

The cost of cultivation was estimated by using cost concepts like Cost A₁, Cost B, and Cost C. In the present study, components of Cost A₁include cost of seeds, labor, organic manures, inorganic fertilizers, plant protection chemicals, interest on working capital, depreciation, and land revenues.etc. The details on the cost of cultivation for IPM and non-IPM farmers are presented in Table 3.

Table 3: Cost and Returns Structure of IPM and Non-IPM Farmers (Rs/ha)

S. No	Particulars	IPM Farmers	% to the Total	Non-IPM Farmers	% to the Total
I	Costs				
A	Cost 'A₁'				
	Hired human labour	60813	40.22	65578	41.24
	Machine labour	3809	2.51	3928	2.47
	Seed	6120	4.04	6672	4.19
	Organic Manures	2700	1.79	1800	1.13
	Fertilizers				
	N	2520	1.66	3006	1.89
	P	5226	3.45	5545	3.48
	K	3274	2.16	3466	2.18
	Micro nutrients	1409	0.93	1389	0.88

Table 3: Contd.,					
	Plant protection charges	36,536*	24.16	38,033	23.92
	Interest on working capital @ 12 %	7345	4.85	7765	4.88
	Depreciation	1572	1.03	1216	0.76
	Land revenue and other cesses	35	0.02	35	0.02
	Total cost A₁	1,31,359	86.90	1,38,433	87.08
B	Cost 'B'				
	Cost A ₁	1,31,359	-	1,38,433	-
	Rental value of land	12350	8.17	12350	7.77
	Interest on fixed capital @12%	1675	1.10	1628	1.02
	Total cost B	1,45,384	96.16	1,52,411	95.86
C	Cost 'C'				
	Cost B	1,45,384	-	1,52,411	-
	Family labour	5791	3.83	6570	4.13
	Total cost C	1,51,175	100.00	1,58,981	100.00
II	Returns				
	Gross returns	2,69,509		2,35,734	
	Net returns	1, 18,334		76,753	
	Additional gross returns over non-IPM	33,775		-	
	Additional net returns over non IPM	41,581		-	
	B:C Ratio	1.78		1.48	

*includes cost on IPM components

Hired Human Labour Cost

Human labor cost was evaluated from the actual wages paid by the farmer. Human labor was measured in man days. Significant differences were found in the prevailing wage rate in Kurnool district. The average wage rate was Rs.150 for men and Rs. 100 for female per day of six hours. The family labor cost was imputed at the market wage rate prevailing in the locality. The managerial functions performed by the family members were evaluated on the basis of the time spent on the farm.

Machine Power

Machine power was charged at the prevailing rates in the respective villages. In the study area, the average charge paid for the hiring of the tractor was Rs.650 per hour.

Seed Cost

The seed cost was arrived by multiplying the number of seeds used by the sample farmer and the prevailing market price. In the present study, the average seed cost was found to be Rs 240 per 10gm.

Interest on Fixed Capital

The interest on fixed capital was evaluated at the prevailing interest rate of 12 per cent per annum on the current value of fixed assets and the cost of capital was calculated for the cropping period. In the present study, the interest on fixed capital was estimated to be Rs.1675per hectare for IPM farmers whereas it was Rs.1628 per hectare for non-IPM farmers of chili cultivation which has indicated that farmers are on par status as far as the fixed assets are concerned.

Interest on Working Capital

In chilies cultivation, the inputs were not used at a time but at different points of time according to the requirements of the crop. Hence, the interest calculated on working capital was reduced to half of the crop period. In this study, interest on working capital was Rs. 7345 in case of IPM farmers and Rs. 7765 per hectare for non-IPM farmers.

Rental Value of Owned Land

The imputed value of land rents prevailing in the study area is considered as the rental value of owned lands. The contribution of land towards the crop enterprise was accounted for based on the rental value of the land prevalent in the area. The rent paid annually in the study area was Rs. 12,350 per hectare.

Taxes or Land Revenue

The yearly land revenue paid was reckoned at the actual payments made in the study area. In this study area, the land revenue was Rs. 35 per hectare.

Manures, Fertilizers and Plant Protection Chemicals

Cost of manure was calculated based on the prevailing market rate in the area. Chemical fertilizers and plant protection chemicals were valued at the actual payment made by the farmer. The cost per ton for organic manure was found to vary between Rs. 500 to Rs. 700 per ton.

The costs and returns in IPM and non-IPM farmers' category were influenced by both endogenous and exogenous factors. In chili cultivation, the cost and returns of IPM and non-IPM farmers play an important role in determining the profitability.

Among the two categories of the farmers, the higher amount of Rs. 1,38,433 was incurred as cost 'A₁' by the non-IPM farmers while it was observed to be Rs. 1,31,359 for IPM farmers. The difference was found to be Rs. 7,074 indicating the higher use levels of various inputs by non-IPM farmers including plant protection measures. The cost B was higher in case of non-IPM farmers with Rs. 1,52,411 whereas it was Rs. 1,45,384 in case of IPM farmers. The gross returns for IPM farmers were observed to be higher (Rs. 2,69,509) as compared to non-IPM farmers (Rs. 2,35,734) as a result of the increase in productivity. Similarly, the net returns realized by IPM farmers were also higher (Rs. 1,18,334), than that of non-IPM farmers (Rs. 76,753). The cost of cultivation under the IPM farmers category was (Rs. 1,51,175 per ha) lower than the cost incurred by non-IPM farmers (Rs. 1,58,981 per ha) which was due to the reduction in the cost of plant protection measures.

In order to realize the higher levels of quality and productivity, the IPM farmers had incurred an amount of Rs. 6,587 per hectare as an additional cost on IPM components. As a result of this, the IPM farmers had realized an additional income of Rs. 33,775. The IPM farmers have realized Rs. 41,581 of net returns (profit) over the non-IPM farmers. Further, the higher benefit-cost ratio was observed with respect to IPM farmers at 1.78 as compared to a lower benefit-cost ratio of 1.48 for non-IPM farmers.

It could also be observed that for non-IPM farmers' additional cost of Rs. 4765 was due to the use of more human labor than IPM farmers. In cost C it could be observed that non-IPM farmers had incurred Rs. 778 more on family labor than IPM farmers. Out of the total costs both IPM and non-IPM farmers had incurred 86.90 per cent and 87.08 per cent respectively on cost A₁ than the other costs.

The results have also revealed that the additional cost associated with the IPM practicing farmers was found to be Rs. 6,587 per ha. This was due to the fact that the IPM farmers had used IPM components module in chili cultivation. The use of additional costs which were involved, mainly for using the pheromone traps, bird perches, sticky traps, biological agents and botanicals. On the other hand, all these operations were not practiced by the non-IPM farmers. Hence the IPM farmers had incurred the said additional cost. Further, with this additional cost, the IPM farmers had realized additional net benefits (Rs. 41,581 per hectare) over non-IPM farmers. This was obtained due to the increased yield and quality levels of chili over non-IPM practices. Thus, IPM practices had not only brought additional profits but also helped in bringing stability in the ecosystem by reducing the use of external resources. As a result of this, IPM technology has been considered as eco-friendly, economical and socially acceptable particularly in chili cultivation.

Table 4: Quantities of Inputs Utilized and Cost Incurred by IPM and Non-IPM Farmers (Per Hectare)

Inputs	Units	IPM Farmers		Non IPM Farmers	
		Qty	Value	Qty	Value
Seeds	Kg	0.255	6120(4.46)	0.278	6672(4.60)
Labour					
Hired human labour	Man days	405.42	60813 (44.34)	437.19	65578 (45.22)
Family labour	Man days	38.61	5791 (4.22)	43.80	6570 (4.53)
Machine labour	In hrs	5	3809(2.77)	5.14	3928 (2.70)
Sub Total			76533 (55.80)		82748 (57.00)
Manures and Chemical Fertilizers					
Manures (FYM)	Tonnes	5	2700 (1.96)	3.33	1800 (1.24)
Chemical fertilizers					
N	Kg	206.39	2520 (1.83)	246.16	3006(2.07)
P	Kg	32.66	5226 (3.81)	34.66	5545 (3.82)
K	Kg	111.00	3274 (2.38)	117.50	3466 (2.39)
Micro nutrients	Kg	20.13	1409 (1.02)	19.84	1389 (0.95)
Sub Total			15129 (11.03)		15206 (10.48)
Inputs	Units	IPM Farmers		Non IPM Farmers	
Plant Protection Components					
IPM components	Rs		6587 (4.80)		-
Insecticides	Rs		14241 (10.38)		18545 (12.78)
Fungicides	Rs		15708 (11.45)		18331 (12.64)
Herbicides	Rs		-		1157 (0.79)
Sub Total			36536 (26.63)		38032 (26.22)
Other Components					
Interest on working capital	Rs		7344 (5.35)		7765 (5.35)
Depreciation	Rs		1572 (1.14)		1216 (0.83)
Land revenue and other cesses	Rs		35 (0.02)		35 (0.02)
Sub Total	Rs		8952 (6.52)		9016 (6.21)
Total	Rs		1,37,150 (100.00)		1,45,004 (100.00)
Yield	Otl	56.00	2,69,509	52.79	2,35,735

(Figures in parentheses are percentages)

It could be observed from the table that the difference in the share of inputs to the total cost of cultivation is marginal though there are differences in their monetary values. The inputs like labor have accounted for nearly 55.80 per cent in IPM farmers while the same was found to be nearly 57.00 per cent in non IPMfarmers category. The same trend was witnesses almost for all the inputs except farmyard manure where IPM farmers have used 1.67 ton per ha more than the non-IPM farmers. Apart from this, the IPM farmers had realized an additional yield of 3.21 quintals of chili per hectare over non-IPM farmers.

The blanket recommendation of fertilizers for chili was 295:59:118 kg per ha in terms of N, P and K, whereas the IPM farmers are applying 88.61 kgs of N, 26.34 kgs of P and 7 kgs of K less than the blanket recommendation. In case of non IPM farmers, they are applying 48.84 kgs of N and 24.34 kg of P less than the blanket recommendation.

Under the plant protection component, the expenditure pattern for non-IPM farmers has indicated that Rs.1, 496 per hectare was incurred as an additional expenditure over IPM farmers. This has clearly indicated that in order to control the insect pests in chili, the non-IPM farmers had relied more on the use of synthetic chemicals, which is hazardous to the human health and also interfere in the activities of the beneficiary insects which prey upon larvae.

On the other hand, the IPM farmers had restricted their expenditure on the plant protection components to Rs.29, 949 per hectare, which had helped in the management of insect pests in chili by resorting to cultivation of trap crops, biological and botanical agents. At the same time, the non-IPM farmers have made an expenditure of Rs. 36,876 towards pesticides and fungicides indicating the usage of more chemicals which are highly harmful in damaging the environment and the quality of the produce.

The IPM farmers had realized higher productivity at 56.00 qtl per hectare as compared to non-IPM farmers 52.79 qtl/ha a difference of 3.21 qtl per hectare.

Partial Budget Showing the Change from IPM to Non-IPM Chili Cultivation

For taking a specific farm management decision, the help of partial budgets is essential. Partial budgeting is a statement of added cost and added returns as a result of a change in one or a few activities of the farm such as increase or decrease in the level of the enterprise, the introduction of a new enterprise, etc. Here the change will be in the way of adopting IPM or otherwise. The details of the partial budgeting are presented in Table 4.

Table 5: Partial Budget Showing the Change from IPM to Non IPM Chilli Cultivation (Rupees Per Hectare)

Debit (A)			Credit (B)	
	Added Cost		Added Return	
I	Organic fertilizers	900	Gross return	33,775
Ii	Micro nutrients	20	(Difference between the gross return of IPM and non-IPM chilli per hectare)	
Iii	Interest on fixed capital	47		
Iv	Depreciation	356		
V	IPM components	6,587		
Reduced Revenue			Reduced Cost	
I	-	-	Human labour	5,544
Ii	-	-	Machine labour	119
Iii	-	-	Seed	552
Iv	-	-	Fertilizers	997
V	-	-	Plant protection charges	8,084
Vi	-	-	Interest on working capital	420
Reduced Revenue			Reduced Cost	
	A. Total added cost and reduced return	7,910	B. Total added return and reduced cost	49,491

Table 6

Net change in Income	=	B-A
	=	42,904 -1,323
	=	Rs.41,581

Since the cultivation of chili with IPM practices had given an additional income of Rs.41, 581 per hectare compared to non-IPM chili, the farmer could as well switch over to IPM chili cultivation.

SUMMARY AND CONCLUSIONS

Net returns of the sample respondents from chili was analyzed and results have revealed that majority (36.67 per cent) of the IPM farmers belonged to the net returns group of Rs.115001 to 125000 and whereas in case of non-IPM farmers 38.33 per cent of the respondents belonged to Rs.85001 to 95000. Cost and returns structures were calculated separately for IPM and non IPM farmers. Total cost A_1 is more for non-IPM farmers when compared to IPM farmers; it was Rs. 1, 38,433 for non-IPM and Rs. 1, 31,359 for IPM farmers.

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